The African Organisation for Standardisation

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ARS 908 (2012) (English): Fresh breadfruit -- Specification

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AFRICAN STANDARD

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Fresh breadfruit — Specification

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Foreword

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This African Standard was prepared by the ARSO Technical Harmonization Committee on Agriculture and Food Products (ARSO/THC 1).

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Introduction

Breadfruit is a versatile food and can be cooked and eaten at all stages of maturity, although it is most commonly harvested and consumed when mature, but still firm, and used as a starchy staple. The relatively bland fruit can form the basis for an array of dishes, and it takes on the flavour of other ingredients in the dish. Very small fruits, 2-6 cm or larger in diameter, can be boiled and have a flavour similar to that of artichoke hearts. These can be pickled or marinated. Mature and almost mature breadfruit can be boiled and substituted for potatoes in many recipes. Ripe fruits are very sweet and used to make pies, cakes and other desserts.

The dried fruit has been made into flour and substituted in part for wheat flour in bread making. The combination has been found more nutritious than wheat flour alone. Breadfruit flour is much richer than wheat flour in lysine and other essential amino acids. In Jamaica, the flour is boiled, sweetened, and eaten as porridge for breakfast.

Soft or overripe breadfruit is best for making chips. The seeds are boiled, steamed, roasted over a fire or in hot coals and eaten with salt. In West Africa, they are sometimes made into a puree.

Niacin content can rise up to 8.33 mg in dried, ground seeds.

The seedless breadfruit is low in protein, the seeds considerably higher, and therefore the seeded breadfruit is actually of more value as food.

Breadfruit flour contains 4.05% protein; 76.70% carbohydrates, and 331 calories, while cassava flour contains, 1.16% protein, 83.83% carbobydrates, and 347 calories per 100 g.

The multiple uses of breadfruit is of special significance to African interests in terms of fulfilling many functions such as food security, wood uses and forestry needs. This African Standard was prepared to provide requirements necessary to facilitate trade for fruits and vegetables noting the significance of these products in agriculture and rural development as well as poverty alleviation.

Fresh breadfruit — Specification

1 Scope

This Standard applies to commercial varieties of breadfruit grown from *Artocarpus altilis* of the family *Moraceae*, to be supplied fresh to the consumer, after preparation and packaging.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ARS 53, *General principles of food hygiene — Code of practice*

ARS 56, *Prepackaged foods — Labelling*

CAC/GL 21, *Principles for the establishment and application of microbiological criteria for foods*

CAC/RCP 44, *Recommended international code of practice for the packaging and transport of tropical fresh fruits and vegetables*

CAC/RCP 53, *Code of hygienic practice for fresh fruits and vegetables*

CODEX STAN 193, *Codex general standard for contaminants and toxins in food and feed*

ISO 874, *Fresh fruits and vegetables — Sampling*

ISO 2169, *Fruits and vegetables — Physical conditions in cold stores — Definitions and measurement*

ISO 6561-1, *Fruits, vegetables and derived products — Determination of cadmium content — Part 1: Method using graphite furnace atomic absorption spectrometry*

ISO 6561-2, *Fruits, vegetables and derived products — Determination of cadmium content — Part 2: Method using flame atomic absorption spectrometry*

ISO 6633, *Fruits, vegetables and derived products — Determination of lead content — Flameless atomic absorption spectrometric method*

ISO 6634, *Fruits, vegetables and derived products — Determination of arsenic content — Silver diethyldithiocarbamate spectrophotometric method*

ISO 6637, *Fruits, vegetables and derived products — Determination of mercury content — Flameless atomic absorption method*

ISO 7563, *Fresh fruits and vegetables — Vocabulary*

ISO 7952, *Fruits, vegetables and derived products — Determination of copper content — Method using flame atomic absorption spectrometry*

ISO 9526, *Fruits, vegetables and derived products — Determination of iron content by flame atomic absorption spectrometry*

ISO 17239, *Fruits, vegetables and derived products — Determination of arsenic content — Method using hydride generation atomic absorption spectrometry*

3 Definitions

For the purposes of this standard, the terms and definitions in ISO 7563, and the following terms and definitions apply.

3.1
similar varietal characteristics
breadfruit in any lot have the same general shape, colour, characteristic of skin and flesh

3.2
clean
free from adhering soil, latex, pest and foreign matter

3.3
firm
not soft, nor shrivelled

3.4
maturity
the breadfruits are at a stage of development that is suitable for the market requirement

3.5
disease
any visible defect or combination of defects caused by micro organisms

3.6
well shaped
breadfruits shall have the shape characteristic of the variety

3.7
fairly well shaped
85% or more of breadfruits shall not be flat sided or any way abnormal in shape

3.8
damage
any defect or combination of defects of physical or physiological causes which detracts from the edible or marketing quality such as scars or bruises

3.9
serious damage
any defect or combination of defect of physiological or physical (external or internal causes such as cuts punctures and internal dehydration which could lead to the abnormally quick deterioration of the fruit and cause rejection

3.10
latex
the residue from the sap

3.11
well trimmed
breadfruits' stem is intact with length not greater than 2.5 cm. above the shoulder of the fruit

3.12
fairly well trimmed
85% or more of breadfruits in any lot shall have stems intact with length not greater than 2.5 cm long above the shoulder of the fruit

3.13
similar maturity
there shall be no very distinct visual difference in maturity between breadfruit in the same box or lot

3.14
weight
the weight stated on the container shall be the minimum net weight delivered to the customer

3.15
major defects

— **Insects**	With evidence of live insects or insect infestation.
— **Diseases**	With evidence of fungal or bacterial rots.
— **Physical / pest damage**	With unhealed cuts, holes or splits from physical or pest damage.
	With large areas of brown discolouration (latex leakage).
— **Physiological disorders**	With evidence of dry hard flesh or flesh lifting from shell (dehydration).
	With angular skin segments and glossy green skin colour (excessive immaturity)
	With strong odour (excessive maturity).
— **Temperature injury**	With skin browning/blackening and areas of softened flesh (chilling injury).

3.16
minor defects
— physical/pest damage — *With superficial bruising > 2 sq cm.*

— Skin marks / blemishes — *With healed scars > 2 sq cm.*

4 Provisions concerning quality

4.1 General

The purpose of the standard is to define the quality requirements of breadfruits at the market-control stage, after preparation and packaging.

The holder/seller of products may not display such products or offer them for sale, or deliver or market them in any manner other than in conformity with this standard. The holder shall be responsible for observing such conformity.

4.2 Minimum requirements

4.2.1 In all classes, subject to the special provisions for each class and the tolerances allowed, the breadfruit must be:

(a) intact, firm and of similar varietal characteristics;

(b) sound, produce affected by rotting or deterioration such as to make it unfit for consumption is excluded;

(c) clean, practically free of any visible foreign matter;

(d) practically free of pests affecting the general appearance of the produce;

(e) practically free of damage caused by pests;

(f) free of abnormal external moisture, excluding condensation following removal from cold storage;

(g) free of any foreign smell and/or taste;

(h) free of damage caused by low and/or high temperatures;

(i) free of damage caused by frost;

(j) free of signs of internal shrivelling;

(k) practically free of bruising and/or extensive healed-over cuts.

The breadfruits must have been carefully picked and have reached an appropriate degree of development and ripeness account being taken of the characteristics of the variety, the time of picking and the area in which they are grown.

4.2.2 The development and condition of the breadfruits must be such as to enable them:

(a) to withstand transport and handling; and

(b) to arrive in satisfactory condition at the place of destination.

4.3 Maturity criteria

The maturity of breadfruits is defined by the following parameters:

— Colour — Dark green to greenish yellow skin with light brown markings, cream to yellow flesh.

— General visual appearance — Smooth, pebbled skin composed of small rounded segments; skin often with brownish latex stains; short stem present with clean cut.

— Fully mature fruits show a dark green skin color, a light browning and a lack of luster, when compared to less mature fruits. In addition, the segments on the surface of the fully mature fruits are more rounded and smoother than less mature fruits, in which they tend to be angular and ridged. Full maturity is also indicated by the presence of latex stains on the surface of the fruit. Over-mature fruit are indicated by a slight yellowing of the skin, together with a yellowing of the stem. Breadfruits showing these characteristics should not be used for export.

— Shape — Generally round to oval, not badly misshapen

— General appearance — Rough skin composed of small spiny segments; skin often with brownish latex stains; short stem present with clean cut

— Sensory — Firm fruit with moderately thin skin, flesh somewhat soft, sweet, and aromatic when fruit is fully ripe; may contain many brown seeds or be seedless

4.4 Classes

Each class shall be graded according to its general appearance, quality and condition.

4.4.1 Class I

The fruit is of similar varietal characteristics, similar maturity, not overripe, clean, well trimmed, fairly well formed: free from soft bruises, decay, worm holes, growth cracks, cuts or other skin breaks, and damage caused by discoloration or scars, disease, insects, mechanical or other means.

4.4.2 Class II

The fruit is of similar varietal characteristics, similar maturity, well shaped, not overripe, fairly well trimmed, fairly clean and reasonably free from soft bruises, cuts and other skin damages, free from decay, worm holes and growth cracks.

4.4.3 Class III

The fruit is of similar varietal characteristics, mature, fairly well shaped, not overripe, fairly well trimmed, fairly clean and reasonably free from soft bruises, cuts and other skin damages, free from decay, worm holes and growth cracks.

5 Provisions concerning sizing

Size is determined by the weight of the fruit as follows:

- Large, weighing 2500 grammes and above.
- Medium, weighing from 1500 – 2500 grammes to less than 16 kilogrammes.
- Small, weighing from less than 1500 grammes.

6 Provisions concerning tolerances

Tolerances in respect of quality and size shall be allowed in each package for produce not satisfying the requirements of the class indicated.

6.1 Quality tolerances

6.1.1 Class I

Not more than 5% by number or weight of breadfruit shall fail to meet the specifications of this grade but those of Class II. There shall be zero tolerance for damage at the dispatching stage.

6.1.2 Class II

Not more than 10% by number or weight of breadfruit shall fail to meet the specifications of this grade but meet those of Class III. Damage shall not exceed more than 2% at the dispatching stage.

6.1.3 Class III

Not more than10% by number or weight of breadfruit shall fail to meet the minimum quality and grade requirements.

6.2 Size tolerances

For all classes, ten percent (10%) by number or weight of breadfruit corresponding to the size immediately below or above the size indicated on the package.

7 Provisions concerning presentation

7.1 Uniformity

The contents of each package must be uniform and contain only breadfruits of the same origin, variety and/or commercial type, quality and size, and appreciably of the same degree of maturity and development. The visible part of the contents of the package must be representative of the entire contents.

7.2 Packaging

Breadfruits must be properly packed in such a way as to protect the produce. The materials used inside the package must be new[1], clean, and of a quality such as to avoid causing any external or internal damage to the produce. The use of materials, particularly of paper or stamps bearing trade specifications is allowed, provided the printing or labelling has been done with non-toxic ink or glue.

Breadfruits shall be packed in each container in compliance with CAC/RCP 44.

7.2.1 Description of containers

The containers shall meet the quality, hygiene, ventilation and resistance characteristics to ensure suitable handling, shipping and preserving of the breadfruits. Packages must be free of all foreign matter and smell.

8 Marking or labelling

8.1 Consumer packages

In addition to the requirements of EAS 38, the following specific provisions apply:

8.1.1 Nature of produce

If the produce is not visible from the outside, each package (or lot for produce presented in bulk) shall be labelled as to the name of the produce and may be labelled as to the name of the variety and/or commercial type.

8.2 Non-retail containers

Each package must bear the following particulars, in letters grouped on the same side, legibly and indelibly marked, and visible from the outside, or in the documents accompanying the shipment.

8.2.1 Identification

Name and address of exporter, packer and/or dispatcher. Identification code (optional). [2]

8.2.2 Nature of produce

Name of the produce if the contents are not visible from the outside. Name of the variety and/or commercial type (optional). [3]

8.2.3 Origin of produce

Country of origin and, optionally, district where grown or national, regional or local place name.

8.2.4 Commercial Identification

— Class and variety;

— Number of fruit container (count);

— Grower/lot identification number;

— If appropriate, a statement indicating the use of preservatives;

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[1] For the purposes of this Standard, this includes recycled material of food-grade quality.

[2] The national legislation of a number of countries requires the explicit declaration of the name and address. However, in the case where a code mark is used, the reference “packer and/or dispatcher (or equivalent abbreviations)” has to be indicated in close connection with the code mark.

[3] The national legislation of a number of countries requires the explicit declaration of the variety.

- Storage temperature
- Net weight of package (kg).

8.2.5 Official Inspection Mark (optional)

9 Contaminants

9.1 Heavy metals

Breadfruits shall comply with those maximum levels for heavy metals established by the Codex Alimentarius Commission for this commodity. The current limits are as indicated below:

Metal	Unit of measurement	Maximum limit	Test method
Lead (Pb)	mg/kg wet weight	0.10	ISO 6633 (AAS)
Cadmium (Cd)	mg/kg wet weight	0.050	ISO 6561-1 or 6561-2

9.2 Pesticide residues

Breadfruits shall comply with those maximum pesticide residue limits established by the Codex Alimentarius Commission for this commodity. Annex E provides current MRLs for the USA, EU and Codex markets.

10 Hygiene

10.1 It is recommended that the produce covered by the provisions of this Standard be prepared and handled in accordance with the appropriate sections of CAC/RCP 1, CAC/RCP 53, and other relevant Codex texts such as Codes of Hygienic Practice and Codes of Practice.

10.2 The produce should comply with any microbiological criteria established in accordance with CAC/GL 21.

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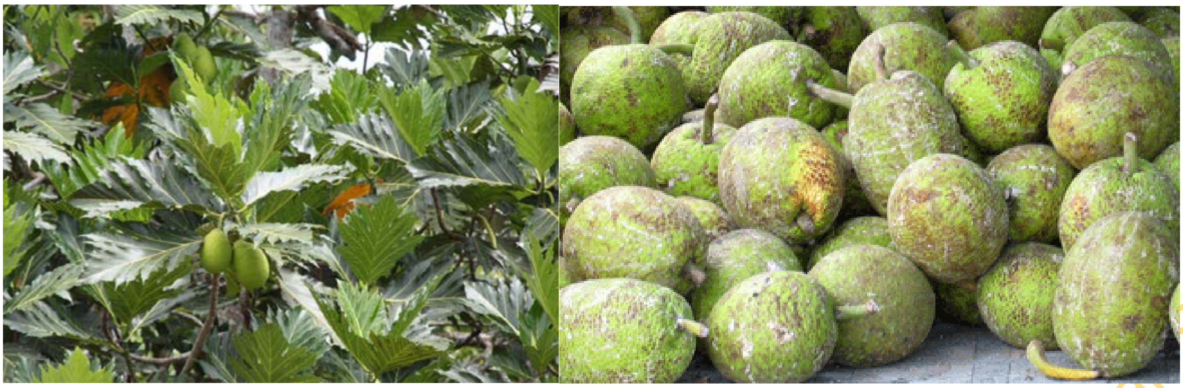
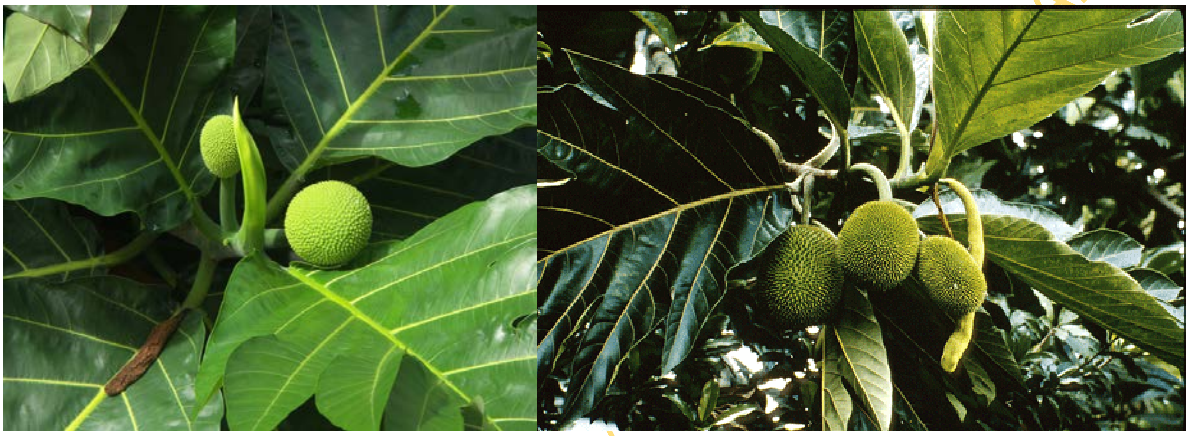


Breadfruit fruiting trees and fresh fruits — Various varieties



Immature breadfruit — Different varieties

Annex B
(informative)

Post-harvest handling and processing

Harvesting

Harvesting should be carried out on the day of shipment, or on the previous day, if cool storage and adequate supervision of grading and packing are available. Harvesting should be carried out in the early part of the day, to avoid buildup of field heat. Due to the nature of the breadfruit tree, harvesting invariably involves climbing the tree. When harvesting, the fruit should be snapped from the tree (at the point adjacent to the branch and not the fruit). The long stems of the fruit harvested in this way, should be removed with a sharp knife to leave the stem flush with the level of the fruit shoulders or slightly protruding (up to 1.5 cm). Harvesting implements may be used. The most suitable involves a pruning pole, where the fruit is cut, allowed to fall and caught by hand or in a net, before hitting the ground. Breadfruit should never be knocked from the tree, dropped or thrown directly to the ground, as the resultant bruising will cause rapid softening. Trimming of the stems should be carried out in the field immediately after harvest and the fruit placed on the ground with the stems downwards to allow latex drainage. Outgrading should be carried out in the field to remove immature, undersized, damaged, bruised, scarred, ripe, or fruits with the stems completely removed.

The fruit of any one tree are of different physiological ages and therefore, all the fruits do not reach maturity simultaneously. Fruit are usually harvested from individual trees on several occasions during the season.

After harvest, latex should be allowed to drain away and the fruit placed in field crates or mesh bags. Harvested breadfruit should not be left in direct sunlight or wind, either in the field or on transport to the packing facilities. On arrival at the packing area, the acceptable fruit should be placed in a tank (containing 100 ppm sodium hypochlorite) for washing to remove fresh latex stains and debris. The fruit should then be placed into field crates and allowed to drain prior to packing.

Export Grading and Packing

Quality checks are required prior to packing to ensure the removal of all fruits not meeting the export requirements, particularly in terms of maturity and mechanical damage. Fruits should be graded in each carton according to the size, giving a range of counts for each shipment. Net weights should range from 12 to 16 kg (27 to 35 lbs). Each individual carton should be weighed, recorded and the carton marked (breadfruit is generally sold on a per kilogram basis, rather than by the carton). Cartons should not be overfilled during packing.

Packaging

Full telescopic two-piece fiberboard carton ("banana" type) or one-piece selflocking waxed carton (bushel type); bursting strength 275 lb/in^2. Fruit dividers may be used to reduce fruit movement and rubbing. Where staples are used, care should be taken to ensure complete staple closure to avoid fruit damage.

Carton internal dimensions:

- 20 x 51 x 34 cm (7.9" x 20" x 13.4")
- 29.5 by 44 by 29,5 cm (12" by 18" by 12")

Pre-cooling

Pre-cooling of breadfruit to 12 °C prior to shipment (by air) is preferable. Harvests made the day prior to shipment should always be placed in cold storage. Temperature controlled rooms are the most suitable. Cooling will be slow if stacking and ventilation are inadequate or if the cooling capacity of the system is low. Cooling is required to a minimum of 12 °C. Iced water or air systems below 12 °C should not be used as this will result in rapid browning of the fruit surface.

Storage

Long term storage of breadfruit for sea shipment under commercial conditions is not feasible, at the present stage of technical development, as high levels of softening are likely to occur. Prolonged storage of more than one day should not be used for air shipments if out-turns are to be acceptable. At storage temperature below 12 °C for even short periods of time, breadfruit will develop chilling injury, which will lead to a drastic reduction in quality and increase spoilage. During storage it should be ensured that ventilation is sufficient to prevent localized build-up of heat and ethylene.

Shipment conditions

Exports should only be made by air. Aircraft pallets are preferable to containers due to the increased ventilation. Short delays and increases in container temperatures within aircraft containers with no ventilation will greatly increase the levels of softening.

Potential post-harvest losses

Losses in breadfruit are as a result of fruit softening.

Mechanical damage

Mechanically damaged fruit will normally deteriorate rapidly and should not be exported. Careful handling should therefore be used during harvesting and subsequent operations such as grading, packing and transportation.

Low temperature

Storage at temperatures below 12 °C will result in chilling injury, as indicated by brown scald-like discoloration of the skin, increased water loss, increased susceptibility to decay organisms and detrimental changes in flavor characteristics.

Pathological factors

Fungal and bacterial infection are rare in breadfruit. They are usually seen as secondary infections where the fruits are very ripe and the internal structure begins to break down.

Bibliography

Standard specification fresh breadfruit, published by the Ministry of Agriculture, Jamaica, 1987 (Revised 1999)